

VARIETIES OF HYDROCELE OF THE *TUNICA VAGINALIS TESTIS* AND SOME ANOMALOUS STATES OF THE *PROCESSUS VAGINALIS*. By JOSEPH GRIFFITHS, M.A., M.D., F.R.C.S., *Assistant to the Professor of Surgery in the University of Cambridge, Pathologist at Addenbrooke's Hospital.*

IN the clinical examination of simple hydroceles of the *tunica vaginalis*, it may be observed that they differ from one another not only in size but also in form: some are more or less globular; others pyriform, with a slight constriction at the junction of the lower broader part with the upper narrower end; while others still are simply ovoidal, with the larger end downwards.

It would seem that these differences in the shape of the distended sac of the *tunica vaginalis* are to be accounted for by the manner in which the serous membrane is disposed to the testicle and epididymis in each particular instance; and in order to display the varieties of disposition of the membrane in the natural state, it is only necessary to distend the sac with air, fluid, or some solid substance. In this manner the mode of disposition of the *tunica vaginalis* to the testis can be determined, and its outline can be delineated in each instance.

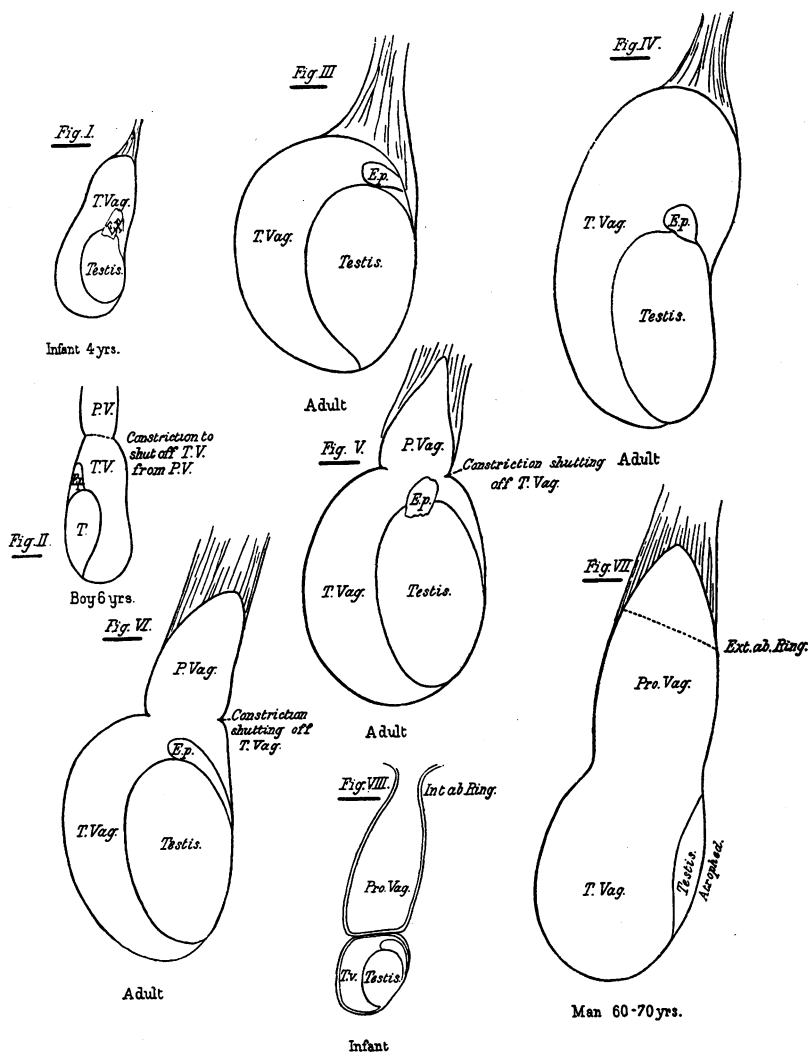
I have adopted the plan of distending the sac with air introduced by means of a special canula, which I formerly used in some experiments to determine the variations in the pressure of the cerebro-spinal fluid, and which was devised for me by Professor Roy.

By means of this canula I have distended the *tunica vaginalis* with air in each of a large number of testicles removed after death, from persons whose ages ranged from one to seventy years. After distension the whole was submerged in strong spirits. On the following day the canula was withdrawn, but the specimen, still distended, was replaced in the spirit, and kept there nearly a fortnight, when, with a long sharp knife, a section was made at or near the middle, in a longitudinal direction from before backwards.

#### SIMPLE HYDROCELE.

In the young *child* the shape of the distended *tunica vaginalis* is almost constant. It is long, extending well above the testicle, at the upper level of which there is usually a slight

constriction in the sac, as is depicted in fig. I. The epididymis, as may be noted, is relatively larger to the body of the organ at this than at any subsequent period.



So far as I have observed, the *tunica vaginalis* is, proportionately to the testicle, larger in the child than in the adult, and its length is relatively greater than its breadth.

The slight constriction in the sac near the upper level of the testicle, noted above, is a constant feature in the distended sac of quite young children,—that is, children up to five or six years of age. At ten and later this is not present, nor does it exist, so far as I am aware, in the adult. At first this constriction might seem identical with the natural one that takes place at the point where the *tunica vaginalis* is shut off from the *processus vaginalis*; but this is obviously not the true explanation, for this slight constriction and that at the junction of the *processus* with the *tunica vaginalis* may exist side by side, as in the case from which the drawing shown in fig. II. was taken. In this specimen, which was removed from the right side of the body of a boy aged six years, both the constriction proper to the *tunica vaginalis* of the child and that which takes place at the line of separation from the *processus vaginalis* are well shown.

In the *adult* the distended *tunica vaginalis* assumes, as a rule, one of two forms, namely, (1) the more or less globular, in which the sac hardly extends above the level of the upper end of the epididymis, as seen in fig. III.; (2) and the other more ovoidal, in which the sac extends an inch or more above the level of the upper end of the epididymis, as seen in fig. IV.

I have not met with any other shape where the *tunica vaginalis* has been completely shut off from the *processus vaginalis*—a process which not unfrequently fails, as will be immediately shown. It is true that in the child, as may be gathered from figs. I. and II., the distended sac assumes a more or less pyriform shape, and that this is the typical child-form; but this form, which is normal to the child, is, I find, uncommon in the adult; and it is only found when the lower end of the *processus vaginalis* remains unobliterated and in free communication with the cavity of the *tunica vaginalis*.

Although the above (the spherical and ovoidal) are the two forms usually assumed by the distended normal *tunica vaginalis* of the adult, it must not be assumed that these forms are always retained in cases of hydrocele; for in hydrocele the chronicity of the malady and the effects of long-standing hydrostatic pressure, which is always greater in the lower than the upper segments of the sac, tend to distend the lower more than the

upper end, and consequently the sac becomes broader below than above, even if this were not so from the beginning. There is, however, another form which is occasionally met with in practice, namely, the *pyriform*. This is in a majority of cases due, so far as I have been able to determine, to incomplete obliteration of the lower end of the *processus vaginalis*, and the persistence of a free communication between its cavity and that of the *tunica vaginalis*. I have found three or more instances after death, and have seen a few in living subjects. In young children the *tunica vaginalis* when distended assumes a more or less pyriform shape. Although, as mentioned, similarly shaped tunics or sacs have not been found in the adult specimens examined, yet it is probable that a certain number of this form of hydrocele, which is now and then met with, results from a persistence of that condition found in children. Sir George Humphry, who first drew special attention to this pyriform shape occasionally assumed by the distended *tunica vaginalis* of the adult, in his article on the "Generative Organs" in *Holmes' System of Surgery*, first edition, supposed that it was due to the shape of the tunic, as, he says, may be proved by blowing air into it [*tunica vaginalis*]. He further remarks that this constriction—that is, the constriction between the upper narrow and the lower broader part—has often led to the supposition that there were two distinct sacs, or that there was a hernia in addition.

Curling, however, in his treatise on "Diseases of the Testis," attributes this shape to less resistance at the upper part of the sac, and considers the extension up the cord to depend in the main upon the length of time the hydrocele has been in existence.

As has been pointed out above, a certain number of these cases may be explicable upon the supposition that the pyriform shape found in young children persists throughout life, but the remainder—which perhaps constitute the majority—are in all probability to be explained only by such cases as the following:—

The testicle, which was removed from a young man of about 20 years of age, showed, after distension of the *tunica vaginalis*, a marked pyriform shape, the narrower part extending for about  $1\frac{1}{4}$  inches up the cord, and the usual constriction was well pronounced,—more, of course, than would be the case when con-

tained within the scrotal tissues as in the living subject. A section of this, see fig. VI., shows the *tunica vaginalis* below and an unobliterated portion of the *processus vaginalis* above, the two cavities being continuous at the seat of external constriction, *i.e.* the point at which the *tunica vaginalis* should have been shut off from the *processus vaginalis*. There is here a distinct valve-like projecting ledge on the inner surface of the sac, which is due to the resistance of the walls of the sac to the pressure which has distended the cavity above and below.

I have two other and similar instances, both of which reproduced the pyriform shape when distended, and also showed the constriction in exactly the same place. One is represented in fig. V. Were it not for this communication between the *tunica* and the *processus vaginalis*, the sac of the former would be of a globular shape in each instance, and would thus resemble that which is seen in fig. III.

In this connection I may mention an interesting example of a typical pyriform hydrocele lately obtained from a man who died from cancer of the stomach in Addenbrooke's Hospital. The hydrocele, which was on the left side, had existed for many years. It was distinctly pear-shaped, with the usual constriction above the level of the testicle; but the narrower end extended upwards within the external abdominal ring, half way up the inguinal canal, where it ended in a blunt cone-like end. The walls of this hydrocele were much thickened, and they contained numerous calcareous plates of irregular size and shape, and the fluid was of a greenish colour, holding in suspension numerous cholesterin crystals.

In this case, as in those above related, the constriction was situated immediately above the level of the upper end of the testicle, which organ had suffered very considerable atrophy from pressure, there being no trace of epididymis visible within the sac. See fig. VIII.

#### THE BILOCULAR HYDROCELE.

There is also another and well known form of hydrocele, namely, the bilocular, which may be regarded as an exaggeration of the preceding, the first example of which was described by

Sir Joseph Lister in the *Edinburgh Medical Journal* (1856), and of which many instances have since been reported by Humphry, Curling,<sup>1</sup> Kocher,<sup>2</sup> Beraud,<sup>3</sup> Bazy,<sup>4</sup> and others.

This form is characterised by being composed of two sacs, the one occupying the *tunica vaginalis*, and the other, which is often the larger, extending to a variable distance in the spermatic cord—it may be to the internal ring, and even beyond this point it may ascend in the abdominal wall between the fascia transversalis and the peritoneum. These two sacs communicate, as a rule, by a narrow opening at a point which corresponds to the natural line of constriction between the *tunica* and the *processus vaginalis*.

The constriction that occurs at the internal abdominal ring in the process of shutting off the *processus vaginalis* from the peritoneal cavity is well recognised, but that which occurs below, immediately above the level of the testicle, in order to shut off the cavity of the *tunica* from that of the *processus vaginalis*, has as yet scarcely received sufficient attention from anatomists and surgeons. In the preceding examples of the pyriform-shaped hydroceles in the adult, the situation of this line is well seen.

The degree of constriction varies in different instances and, accordingly, the aperture of communication between the upper and lower cavities.

It seems therefore pretty clear that these cases of bilocular hydroceles, one locule of which extends up the spermatic cord, are referable to incomplete obliteration of the *processus vaginalis*, and failure of the natural constriction at its lower end to shut it off from the *tunica vaginalis*.

This is the view adopted by Bazy,<sup>5</sup> who based it upon the results of the examination of 68 examples of testicles removed at all ages up to 13 years. In two of these he found that the *processus vaginalis* remained open up to the external abdominal ring, though, owing perhaps to his method of

<sup>1</sup> Curling, *op. cit.*

<sup>2</sup> Kocher, "Die Krankh. d. Männ. Geschlecht Org.," *Deutsche Clin. Chir.*, 1887.

<sup>3</sup> Beraud, *Arch. Gen. de Med.*, 1856.

<sup>4</sup> Bazy, *Arch. Gen. de Med.*, 1887.

<sup>5</sup> Bazy, *op. cit.*

investigation, he did not show the line of constriction between the upper or *processus*, and the lower or *tunica vaginalis*.

It appears that the *processus vaginalis* may be shut off from the peritoneal cavity at the internal ring, while the rest of its canal to a greater or less extent may remain patent; on the other hand, the *processus* may also be shut off from the *tunica vaginalis* below, while the upper portion remains patent to the peritoneal cavity,—the shutting-off process having taken place at the lower line of constriction noted above (see figs. III. to VII.).

When the *processus* is thus shut off from the *tunica vaginalis* at this line, and when it remains open above, then there may occur a not unfrequent variety of congenital hernia, first described and figured by Scarpa. In this case the hernia does not reach the cavity of the *tunica vaginalis*, being separated from it by the obliterated lower end of the *processus*, which constitutes a kind of septum.

The following are interesting examples of this condition, which I lately placed in the Pathological Museum of the University of Cambridge.

In one of these the hernia was on the right side only, in the other there was hernia on both sides. As both show precisely the same conditions, I shall only describe one. It was in a child 2 to 3 years of age, who died of inanition. There was a hernial sac which extended down to the *testis*, and opened into the peritoneal cavity by a small opening large enough to admit the tip of the little finger. The sac, which was the unclosed *processus vaginalis*, and into which the *vas deferens* projected, was of uniform size down to the *testis*, where it was completely shut off from the *tunica vaginalis*, as seen in fig. VIII.

Hunter, in his monograph on the "Descent of the Testicle," expresses his opinion that the *processus vaginalis* begins to close above, and that the closure gradually proceeds downwards until it reaches the upper end of the testicle, where the process of obliteration ceases. This may be true of the normal mode of closure of the *processus vaginalis*, but certain it is that (1) the lower extremity closes first in some instances; (2) both extremities may close, leaving the intermediate portion

unobliterated; and (3) the upper end only may close, all below remaining patent, and in free communication with the *tunica vaginalis*.

#### MULTILOCULATED VAGINAL HYDROCELE.

I have been fortunate enough to discover in the post-mortem room four examples of the multiloculated variety of hydrocele

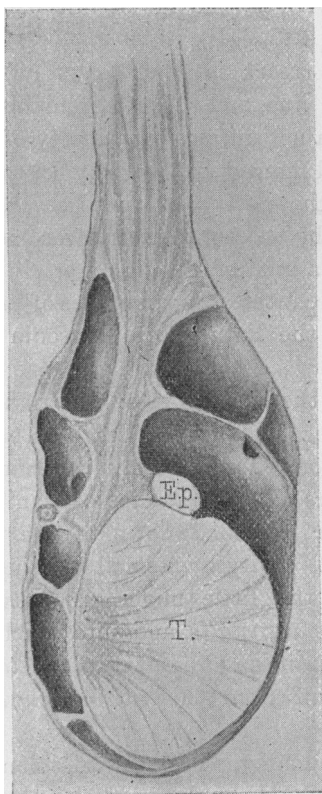


FIG. IX. Multiloculated Vaginal Hydrocele in a Middle-aged Man.

of the *tunica vaginalis*, which is rarely if ever recognised in practice; accordingly, I venture to give an account of them here.

They are, I need hardly point out, quite distinct, both in their



situation and general characters, from the multiple spermatoceles (see *Jour. of Anat. and Phys.*, vol. xxviii. p. 107). The *first* example (see fig. IX.) was found on the left side in a man aged 69 years, who died from the effects of fractured ribs. The *tunica vaginalis* contained a small quantity of serous fluid, which by being pressed from one part to another, produced irregular bulgings of the sac such as I had not before observed. I, therefore, distended the sac by the method above described and found, after hardening in spirit, the condition depicted. There are in this at least seven locules, varying in size, and separated from one another by thin septa, which are perforated by small, circular, smooth-edged holes of about  $\frac{1}{8}$  in. in diameter. In that manner all the locules communicate with one another.

The *second* example was also from the left side of a man aged 52 years, who died from chronic alcoholism. Here, again, unequal bulgings of the *tunica vaginalis* by the contained serous fluid was observed; and after distension of the sac and hardening, a very marked instance of multiloculated vaginal hydrocele was found.

The *third* was obtained from the left side of a man aged 63 years, who died from cancer of the pylorus. This hydrocele was of long standing, and it had been tapped on at least two occasions. The sac bulged at its upper and fore part, as if it were made up of several distinct locules. After distension with air, the bulged appearance of the upper part of the sac became more pronounced. On section it was found that the *tunica vaginalis* was bulged outwards in several places; and in one place a large cavity, which communicated with the general cavity by means of a small opening, was seen.

The *fourth* was removed from the right side of a man aged 54 years, who died of ruptured hydatid cyst of the liver. Similar bulgings to those in the previous cases were observed. After distension of the sac with air, a vertical section showed a good example of this variety of multiloculated hydrocele. The drawing is represented in fig. X., in which several large locules are seen. Some of these communicated with one another, and with the general cavity, by means of large wide openings, while others had only small, round, smooth-edged holes, as noted in the example first described.

It would seem probable that in all the above examples the locules were in the first instance the result of localised bulgings of the tunica, and that subsequently the bulgings became distinct locules, having in many instances only small openings of

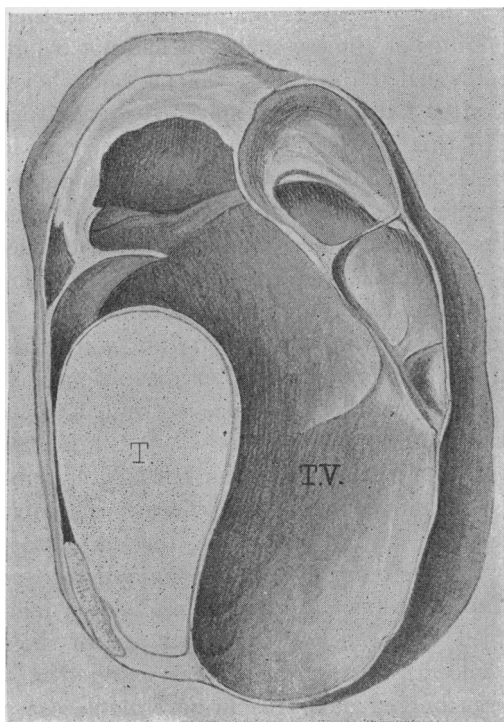


FIG. X. Multiloculated Vaginal Hydrocele in a Man 54 years.

communication between their cavities and that of the general tunic.

Another variety of multilocular vaginal hydrocele that I have met is formed by incomplete septa, evidently the result of previous inflammatory attacks between the visceral and parietal layers of the *tunica vaginalis* subdividing the cavity into two or more parts.

The multiloculated variety of vaginal hydrocele is not unknown, or at any rate some forms of it; for in the first edition

of *Holmes' System of Surgery*, Sir George Humphry mentions a case of hydrocele which he dissected, and in which he found numerous pouches on the external surface of the sac; these pouches communicating with the general cavity by means of small openings. But this is, so far as I am aware, the only instance of its kind described; yet the condition must be of not unfrequent occurrence, though its detection either in the living or in the dead person is not an easy matter. It may be observed, however, that a distinction between a simple and a multilocular vaginal hydrocele during life may have some practical bearing, and may explain some of the cases of failure to cure by injection; and the occasional existence of these complex vaginal hydroceles may indicate the importance of shaking the scrotum vigorously after the injection of iodine or other substance, so that the fluid may come into contact with each and every part of the sac wall.

I may further add, that I have frequently noted minute sac-like protrusions of the serous coats of the *tunica vaginalis*, and these are most frequent at the line of reflection of the parietal on to the visceral layers. Occasionally they are found towards the upper and front part of the sac, but very rarely in the lower half of the tunic.

Beraud<sup>1</sup> described a variety of hydrocele which he called the "Hydrocele Diverticulaire," and in which a pouch of large size was found in front of the *tunica vaginalis*, and this pouch communicated with the general cavity by means of a comparatively small opening. Being interested in the manner in which this diverticulum arose, he distended, in many instances, the *tunica vaginalis* with wax, and so obtained accurate impressions of their interior. These impressions showed that not unfrequently there existed small bulgings in the parietal layer of this serous membrane, and he thought that a further growth of one of such bulgings gave rise to the large diverticulum.

#### CONCLUSIONS.

1. That in the adult the distended *tunica vaginalis* usually assumes either a spherical or an ovoidal shape.

<sup>1</sup> Beraud, *op. cit.*

2. That in the child the sac of the tunica vaginalis is almost always of a pyriform shape, with a slight constriction near the upper level of the testis.

3. That this pyriform shape when met with in the adult is due either to the persistence of the condition found in the child, or to incomplete obliteration of the lower end of the *processus vaginalis*, and the occurrence of a free communication between its cavity and that of the *tunica vaginalis*.

4. That the bilocular form of hydrocele occurs when the *processus vaginalis* remains unobliterated, being, however, shut off from the peritoneal cavity above, but communicating with the *tunica vaginalis* by an opening of variable size, depending upon the degree of constriction at the line of junction of the *processus* and the *tunica vaginalis*.

5. That there is occasionally met with a multiloculated variety of simple hydrocele of the *tunica vaginalis*, in which the locules arise either from bulgings of the serous membrane, or from the formation of incomplete septa between opposed parts of the parietal and the visceral layers.